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Caring for Persons with Spinal Cord Injury: A Mixed Study Evaluation of eLearning Modules Designed for Family Physicians

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Abstract. Family physicians often do not feel comfortable or have the knowledge or experience to adequately treat and manage the needs of persons with Spinal Cord Injury. An eLearning resource was designed to provide family physicians with accessible information to facilitate their treatment of persons with Spinal Cord Injury. **Methods**: This study evaluated the effectiveness of eLearning modules with regard to meeting the learning needs of family medicine residents treating individuals with spinal cord injury. A mixed methods approach, involved collecting and analyzing data from post module quantitative surveys and qualitative interviews. The constructs of the W(e)Learn framework guided data analysis. **Findings**: Family medicine residents reported they enjoyed the learning experience, learned new information

and raised their awareness of specific health care needs with regard to treating and managing persons with spinal cord injury. Residents confirmed designing the resource to be accessed anytime and anywhere will enable them to retrieve information on a need to know basis. A few residents provided examples of how they applied information they learned as a result of completing the resource. **Conclusion**: Effectively designed eLearning modules that address learner needs can be a viable approach to providing information to physicians regarding treating and managing persons with spinal cord injury.

Keywords: spinal cord injury; eLearning; family medicine; residents; curriculum

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1. Introduction

Individuals with spinal cord injury (SCI) face many challenges in maintaining health and wellness. Barriers to health care include environmental factors such as the lack of wheelchair ramps, inaccessible doctor's office space to maneuver or transfer to an examination table and lack of appropriate equipment such as height-adjustable examination tables and grab bars (Guilcher, Munce, & Couris, 2010; Hwang, Johnston, & Tulsky, 2009). Additional complications to appropriate health care include physicians and health professionals negative attitudes toward disability (McColl, 2006), limited health professional knowledge regarding care needs (McColl, Forster, & Short, 2008; McMillan et al. 2014) and health system disincentives for providing care to persons with SCI (DeJong, 1997; Marks, & Teasell, 2009). Many primary care physicians are not knowledgeable about SCI and its effects on all body systems and therefore may be reluctant to assume care for SCI patients (Donnelly et al. 2007; SCIRE, 2010). Due to the lack of accessible knowledge and services, the primary care for many individuals with SCI is in the emergency room (Guilcher et al., 2010). Persons with physical disabilities often have many unmet health needs and are a population that may have high health care costs due to complex secondary conditions and higher utilization of emergency departments and hospitals (Guilcher et al., 2010; McColl et al., 2009). Surprisingly, medical school and residency training usually includes little, if any, experiences with physical disability (Long-Bellil, et al, 2011). Some providers are said to lack "disability literacy" or "disability competence" akin to the notion of "cultural competence" when providers do not fully understand the issues at hand or do not relate to the patient in an appropriate manner (Special Interest Group on SCI Model System Innovation, 2010).

Access to primary care for those with SCI is vitally important as they are at higher risk for comorbid health conditions such as obesity, diabetes, cardiovascular disease and other secondary complications such as pressure ulcers, autonomic dysreflexia, fractures, neurogenic bladder and bowel complications and pain (Krassioukov, Furlan, & Fehlings, 2003). Middleton

(2008) argues that family physicians are well positioned to identify and manage some conditions associated with SCI by systematically reviewing health care concerns and preempting more serious problems this population experiences. Calls for health care reform aimed at improving access to care for individuals with SCI have recommended a coordinated and integrated care model that includes community-based primary care that is patient-focused and ensures capacity building for health care professionals (Hwang et al., 2009; McColl, Shortt, & O'Brien, 2006; Lee, Milligan, Hillier, & McMillan, 2013; Lee, Milligan, Hillier, & McMillan, 2014). There is a critical need to address the lack of awareness and education of resident family physicians with regard to SCI in order to facilitate access to primary care for persons with SCI (SCIRE, 2010).

Designing and delivering training in convenient and accessible eLearning modules was proposed to be a viable approach to providing relevant specific information in this small, high need patient population. In previous studies with health care workers, learners recognised and appreciated the flexibility and convenience online learning afforded and found eLearning to be a successful approach in helping them achieve the learning objectives the resource was designed to meet (MacDonald et al., 2011; MacDonald et al., 2010; MacDonald, Stodel, Hall & Weaver, 2009; MacDonald, Stodel & Chambers, 2008; MacDonald, Stodel & Casimiro, 2006; MacDonald, Stodel, & Coulson, 2004).

The purpose of this study was to evaluate the *Caring for Persons with Spinal Cord Injury* eLearning resource and answer the following research question: How effective are eLearning modules with regard to meeting learning outcomes of family medicine resident physicians treating spinal cord injury?

1.1 Context

The *Caring for Persons with Spinal Cord Injury* eLearning resource was designed specifically for family physicians who care for or are considering providing care for, persons with SCI in their practice. Design took place over a 12-month period (December 2011- November 2012) and involved a team of subject matter experts (three family physicians; two physiatrists with expertise in SCI, a psychiatry resident with expertise in SCI, and an advanced practice nurse with expertise in SCI); an instructional designer, a curriculum and evaluation expert, eLearning and medical educational researchers; a computer programmer; a graphic designer; and two administrators in SCI who also are persons with SCI. The completed program was beta tested by six family physicians. Suggestions were incorporated and identified problems were rectified and the program made freely available on the Ontario Neurotrauma Foundation Website and at **http://eprimarycare.onf.org/.** The resources consists of the following six modules identified by SCI content experts to be relevant for family physicians in treating persons with SCI: Module 1 – Autonomic Dysreflexia; Module 2 – Neurogenic Bladder; Module 3 – Neurogenic Bowel; Module 4 – Pressure Ulcers; Module 5 – Respiratory Complications; Module 6 – Health Promotion and Maintenance. Each module includes the following sections: definitions, prevalence, pathophysiology, signs and symptoms, causes, management and recommendations, follow-up and references.

2. Methodology

2.1 W(e)Learn Framework

The W(e)Learn framework (MacDonald, Stodel, Thompson & Casimiro, (2009); Casimiro, MacDonald, Thompson & Stodel, 2009) was adopted to guide the evaluation of the six eLearning modules. Developed through collaboration between educators, academics, health care professionals, and industry, W(e)Learn reflects expertise in curriculum design, psychopedagogy, and evaluation methods. W(e)Learn outlines four critical dimensions of online inter-professional education—structure, content, media, and service—and is grounded in socio-constructivist theories and inter-professionalism (see Figure 1). W(e)Learn is intended to elicit four levels of outcome, the pinnacle of which is organizational change and the resulting improvement in care delivery that promotes patient well-being (for an interactive version visit http://www.ennovativesolution.com/WeLearn/).

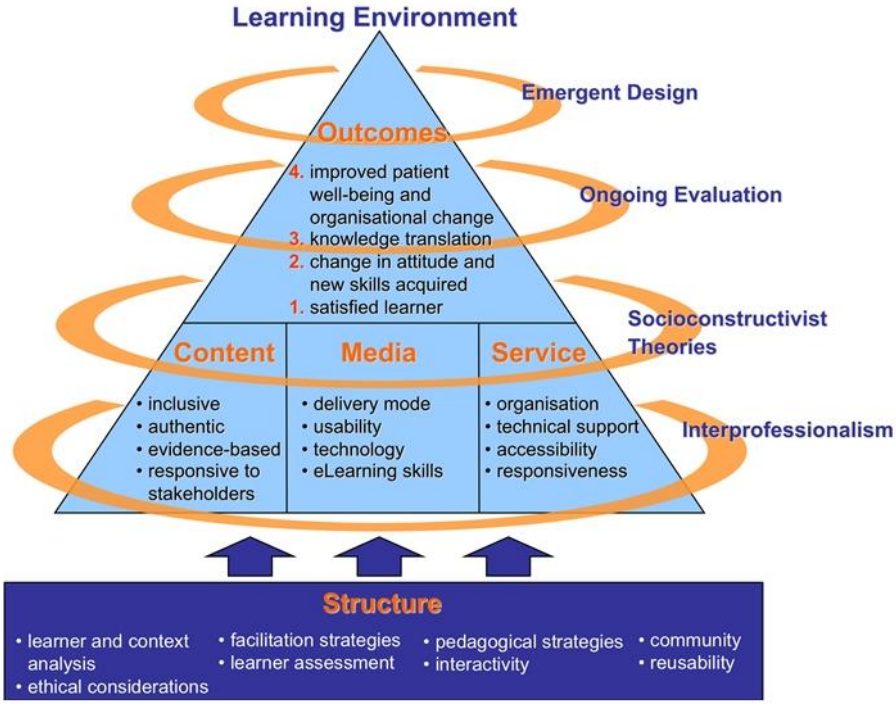

Figure 1: W(e)Learn Framework

2.2 Mixed Methods

A mixed methods design was used to evaluate the eLearning training resource for the reason of combining the strengths of both qualitative and quantitative studies (Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009). In this mixed methods approach, quantitative and qualitative data were collected concurrently to obtain a full understanding of the research questions. This method offset the weaknesses and complements the strengths of the quantitative and qualitative research approaches (Bryman, 2007; Creswell & Plano Clark, 2007; Johnson & Onwuegbuzie, 2004). The mixed methods approach was used as no single

explanation can account for the feasibility of the program (pluralism), as these training modules were established from a complex real-world practice.

2.3 Post Module Survey

The W(e)Learn quantitative post module survey was adapted for this project (see Appendix A). Each participant was asked to complete one survey that encompassed their experience in completing all six of the eLearning modules. The survey took approximately 5-10 minutes to complete.

2.4 Semi-Structured Interviews

The purpose of the interviews was to gain a greater insight into the personal learning experiences of residents with regards to the eLearning modules. Residents were invited to take part in the semi-structured interviews following the completion of the online modules. Ten residents were interviewed, with the duration of the interviews varying from 10-20 minutes, with an average length of 15 minutes. The interviews were guided by a set of open-ended interview questions based on the W(e)Learn Framework and module learning objectives (see Appendix B for the interview protocol). The interviews were audio recorded (with residents' permission) and transcribed verbatim. The interviews took place at a location convenient to the residents on an academic half-day. Lunch and snacks were provided as a sign of our appreciation for participants' time and input.

2.5 Data Analysis

It was critical for the qualitative researcher to ensure that data analysis accurately corroborates the opinions and experiences of the study participants. Stainback and Stainback (1988) describe corroboration as important since it increases the probability that a study's findings will be thought of as important and credible by others. According to O'Donoghue and Punch (2003), an excellent method to determine corroboration is by utilizing triangulation analysis, which they define as a "…method of cross-checking data from multiple sources to search for regularities in the research data" (p.78). This can provide a more accurate and detailed picture of the situation that is being studied (Altrichter, Posch & Somekh, 1996). Denzin (1978) defines several types of triangulation, one of the most reliable of which is the convergence of multiple sources of data. This involved the collection and comparison of several forms of data at different times during the research process.

In order to validate the findings of this study via the triangulation of qualitative and quantitative data, results were compared from the post-module survey, and the individual interviews. Inductive and deductive reasoning were used to interpret the interview data. The writing adopted a narrative tone in order to best capture the experiences of the residents, and direct quotations were included when relevant.

Ethics approval was attained through McMaster University Hamilton Integrated Research Ethics Board (HiREB).

2.6 Qualitative Analysis

Qualitative data analysis was guided by Merriam (2001) and Bogdan and Biklen (1998). The interview transcripts were checked for accuracy by the researcher listening to the audio recording (mp3 file) and comparing them to the transcribed text. Open coding of the text was performed by hand. After a preliminary list of codes was developed, the transcripts were coded a second time to group common codes together to form themes. The coding was reviewed several more times to ensure that no new codes emerge from the data. The data was assigned to categories to provide rich, detailed, and comprehensive information that answered the research questions. A draft report was sent to two additional researchers in this project along with the transcripts to in order to verify the findings.

Relevant information from the emerging themes was used to weave a story from the residents' perspectives portraying current strengths, practices, barriers, enablers and challenges, with regards to the eLearning modules. Direct quotations were used throughout to allow participants' voices to be heard and to obtain objective evidence regarding the residents' perceptions of evaluating the eLearning modules. Residents were provided an opportunity to adapt, remove or elaborate on any quote or text that misrepresented their perspective.

2.7 Quantitative Analysis

The constructs of the W(e)Learn framework (content, delivery, service, structure and outcomes) guided the data analysis of the Post Module surveys. Descriptive statistics and response frequencies were used to assess the learners' experiences with the eLearning modules.

The validity of this research was primarily supported by the triangulation of two different forms of data: post-module survey, and individual interviews. Patton (2002) states that triangulation strengthens research by combining different types of methods or data. As well as the triangulation of the data, any disconfirming information was included in the research report in order to confirm validity.

2.8 Recruitment

Participants included in this study were family physician residents from the Kitchener-Waterloo campus of the McMaster Department of Family Medicine Program in Ontario, Canada. It is a two-year program and residents from both years were invited. The reason we targeted this audience was twofold. Firstly, family medicine residents likely represent a relatively homogenous group of practitioners with similarly limited experience and exposure to individuals with SCI; as "entry-level" practitioners it would seem logical to target this group in terms of appropriateness and value of the eLearning modules.

Also, by providing this information to residents while still in training it is hoped that it will have a long-term effect by filling a needed gap in their medical training.

A total of 34 resident family medicine physicians were invited to be involved in this evaluation project from the Kitchener-Waterloo campus of the McMaster Department of Family Medicine. A 30-minute lunch presentation was given to the residents during the week of December 17, 2014 during Block 7 of their training. The presentation described the rationale for the study and an invitation to participate, plus scenarios/cases were provided to help guide through the modules. Participants were informed of this presentation by email and it was included as an option in their schedule. Residents who volunteered to participate were provided with information regarding the study and informed that they would be expected to complete the modules and a survey. A gift certificate for $15.00 was issued upon completion of the survey. There was also an invitation on the survey (tear off box to tick with email or phone number so their surveys remained anonymous) for residents to indicate their willingness to participate in an interview. During the interview lunch was provided as well as a $15.00 dollar gift card as a sign of our appreciation for residents' time and input.

Prior to completing the survey, residents were required to read and sign an Informed Consent form with a Principal Investigator as a witness. Residents had the opportunity to ask questions or seek clarification about their participation prior to signing the form. Residents were informed (both verbally and in writing) that their participation was strictly voluntary, and that they could withdraw from this project at any time, refuse to participate, and choose not to answer any questions.

3. Qualitative Findings

Ten family physician residents volunteered to participate in an individual follow-up interview. The findings from the ten interviews are chronicled in the ensuing sections. The findings are organized under facets of the W(e)Learn framework: structure, content, service, media, and outcomes.

3.1 Structure

Residents' responses regarding the Structure of the *Caring for Persons with Spinal Cord Injury* online learning resources emerged into three themes: *Learner and Context*, *Pedagogical Strategies,* and *Reusability*. These themes are discussed in the following sections.

3.1.1 Learner and Content

When asked about their interest in SCI, seven of the ten residents interviewed specifically stated that *SCI* was an area in the curriculum not adequately covered and the resource addresses a learning need and gap in medical education. One resident stated, "SCI are common, chronic, and often dealt with in family medicine. I want to be comfortable managing them and know how to do it effectively." A second resident commented, "It is an area we don't get a lot of training in and it does have a lot of specialized knowledge that you need to know as a family doctor." One resident acknowledged the gap in formalized teaching on SCI in medical training. He went on to say, "The needs of that population are unique. The challenges they face are not what you regularly see.

Finding a resource that has everything in one spot definitely piqued my interest."

When asked about their experience with persons with SCI, several residents reported they had been exposed to their supervisor's patients in a Mobility Clinic. One resident stated, "I have seen a few [persons with SCI] in the Mobility Clinic and emergency department but I am only six months in [to my residency program]." One resident shared that when she began her residency, she was intimidated by acquired brain and spinal cord injury. She elaborated:

> We didn't get a lot of training in medical school. I had a patient in our office who had acquired a SCI from a traumatic accident 15 years ago. It was amazing seeing what she has done. She is now walking short distances with assistive devices. I really need to know a lot more about this.

3.1.2 Pedagogical Strategies

Residents identified several pedagogical strategies used in the learning resource that took advantage of new technologies and utilized scenarios drawn from real-life situations. When asked what their favorite part of the resource was, several residents communicated that they were affected by the scenarios. In the words of one resident, "I could really imagine myself as a physician in those situations and seeing patients from that perspective. It affected me on a professional level and I could definitely relate to those experiences." Several residents stated the resource was full of relevant information. One resident stated, "The checklists. The pictures were also nice because they broke up the text a little bit." Another resident identified algorithms as his favorite pedagogical strategy. "There were a lot of really good algorithms throughout giving a stepwise approach and making sure you follow guidelines." Another resident had a list of pedagogical strategies she felt enhanced the resource, "The summary boxes, the take home points, the cases were also helpful, charts." When asked what their least favorite part of the resource was, one resident also highlighted, "All of the stuff in-between and the repetitive definitions."

3.1.3 Reusability

Several residents commented that in addition to treating persons with SCI, the information on pressure ulcers, constipations and degenerative disk disease make the resource valuable to use in several medical situations and with a variety of patients. One resident explained: "I have seen people with pressure ulcers when I am in community and hospital rotations. They don't necessarily have SCI, but having that handy tab for pressure ulcers to go back to is useful." Another resident agreed with the fact that the information provided in the resource is reusable beyond its intended scope. Another resident suggested the resource was versatile and had applicable information for treating a variety of patients. "I have at least one patient who has a traumatic issue and I see tons of elderly patients with a degenerative disk disease or degenerative spinal disease from arthritis causing them symptoms of reduced mobility." Similarly, another resident commented on the value of the resource with the elderly, "My preceptor's practice doesn't have many people with SCI. There are a huge number of elderly patients that have spinal issues." Finally, another resident

suggested that he too would not limit his use of the SCI resource to SCI patients: "The stool chart is something I will use, even for patients without SCI."

3.2 Content

Residents' responses regarding the content in the *Caring for Persons with Spinal Cord Injury* online learning resources emerged into three themes: *Authentic*, *Comprehensive*, and *Engaging*. These themes are discussed in the following sections.

3.2.1 Authentic

All residents stated the content in the resource was authentic. One resident shared, "The content was very clinically relevant. It was organized so you could tap into things that were most relevant. I have tried to use it with a few patients". Similarly, a second resident communicated:

> I was really impressed with the program. The information was very clinically relevant. It definitely raised awareness. I have a better chance of guiding a conversation with someone with these injuries.

When asked if they felt the content in the online modules were authentic and relevant to their practice, one resident stated:

> Especially for the patient I saw six months ago for a physical. I had a letter from the physiatrist that said what her injury was and her level of function. At the time I didn't know what any of those things meant. It would have been really helpful to have done this before. At the same time, I am going to see her again.

Another resident commented on the authentic information the resource provided on diagnosing and managing a person with SCI. "It had things that we should know in terms of management and recognition. This is something a person with autonomic dysreflexia is going to present with…the hypertension."

3.2.2 Comprehensive

Residents consistently said they found the content in the resource inclusive and comprehensive. One resident stated, "The explanations of pathophysiology were very good. Almost all had a picture and it was basic but detailed enough that I felt like I could explain it to a patient. It made sense to me." Another resident elaborated: "I thought it was well put together. It was one of those things where you didn't even know what you didn't know. I was like 'Oh I need to know about this." Another resident voiced, "The objectives overall were to give us an exposure to what these things are and some of the pathophysiology behind it. It was really well done." Finally, a resident shared: "It was very straight forward and basic enough for me to understand. I didn't have any unanswered questions."

3.2.3 Engaging

When asked if the learning modules kept their interest, most residents indicated they did. One resident stated, "They [the modules] kept me motivated. Everything seemed clinically applicable and I could see myself working through these problems. They kept me interested in learning throughout." Another resident commented: "I didn't know this is something that I need to watch out

for in 'this' type of patient. It makes you kind of scared as a doctor. Did it keep me motivated to learn? Absolutely."

Some residents suggested one of the reasons the resource was able to keep their interest was because it didn't take too long to go through. "I was happy in the way it was laid out and how everything seemed to move easily and quickly, no lags."

3.3 Service

Residents' responses regarding the Service in the *Caring for Persons with Spinal Cord Injury* online learning resources emerged into three themes: *Organized*, *Accessibility*, and *Resources*. These three themes are discussed in the following sections.

3.3.1 Organized

When asked what they thought of resource, residents consistently commented that it was organized. One resident stated, "It was really well organized. That was really great. I thought it was good and clear." A second resident stated, "The content was comprehensive, clear, and well organized. Obviously a lot of time was spent making sure that it had everything it needed and was really focused and clear." Lastly, a resident explained her experience with the SCI learning resource, "Overall it was very positive. If I was going for a certain topic, knew it was there, and wanted to brush up, I would go to the areas I wanted."

When asked if the content followed a logical progression, a resident said, "Yes, I wouldn't change the order of anything." Another resident specified: "It seemed logical. I split it up over a couple of nights, but it made sense." Another resident also commented on the logical lay out of the resource. "The information was really well laid out and thought out. I found the diagrams helpful for my basic understanding. It was really practical." One resident reiterated, "It was very user-friendly. If I have a patient or a question about autonomic dysreflexia I could go back and find the information quickly."

Lastly, a resident asserted her appreciation for the organization of the SCI resource; "The way it is laid out is not too intimidating. I could just click on the hyperlinks that I thought were most relevant to whatever patient I am seeing."

3.3.2 Accessibility

The most common theme that emerged was that residents were adamant the resource addressed an important topic omitted in medical school and they expect they will access the resource in the future. One resident commented, "It is nice to go back to something that says this is the presentation, this is how you manage it, this is when you refer, and these are the tests you do." However, residents clarified that because SCI is not something they expect to see often, having an online resource will allow them to access relevant information when they need it.

Residents justified that there are hundreds of medical conditions to cover during family medicine residency, many of which are not covered or adequately covered in their training and some they do not even experience during their

program. Several residents commented this resource would allow them to access the information on SCI in a 'just-in-time' manner. One resident clarified, "This is a handy tool that I can go back to." Another resident reported the resource would be valuable to access in the future, "In the event of a patient with a spinal cord injury who presents with a cough, cold, pressure ulcers, any kind of constipation, I will definitely use this in the future." Another resident agreed, "These are skills I would like to have in my back pocket so I can refer to when I have a patient with a spinal cord injury comes in." Finally, a resident affirmed that she too sees the SCI resource as a valuable source to access relevant information on a need to know basis. "There were some tabs that were content heavy. In real life what is going to happen is I am going to have one patient with a specific concern and I am going to go that tab."

3.3.3 Resources

Residents conveyed they appreciated having the information they needed on SCI conveniently located in one place**.** Residents repeatedly commented they found the links providing access to numerous resources beneficial. One resident explained, "I clicked on a few of them [resource links] and they looked really useful. Access to all relevant resources collected in one place." Likewise, another resident commented on the resources provided in the links, "There were a lot of good links. There was an American Source link that I found very good and bookmarked as well."

3.4 Media

Residents' responses regarding Media in the *Caring for Persons with Spinal Cord Injury* resources emerged into two themes, *Navigating*, and *Technology*. These themes are discussed in the ensuing sections.

3.4.1 Navigating

Every resident reported they found the resource user-friendly and easy to navigate. When asked how they found navigation one resident responded, "Piece of cake. It was really clear and easy to go through." A second resident stated, "They were easy to navigate. Compared to some other eLearning modules, these were very easy to get through." Another resident elaborated; "Whoever you paid to develop your website did a good job. I was impressed with all the graphics. You communicated the ideas effectively. It is nice too because you can use it on a phone." Similarly, a resident commented, "I opened a few links to find more information and I found that was user-friendly." Finally a resident specified, "When I went on I knew exactly what to do."

Several residents stated they appreciated the fact that the *Caring for Persons with Spinal Cord Injury* resource was online. In the words of one resident, "I liked that it is online so I can refer to it whenever I want." Although a few residents stated they glanced at the resource on their phone, most reported they had completed the resource on their desktop computer. One resident revealed, "There was no technical difficulty. It would have been nice to try this on different mediums than just my laptop." A second resident shared, "I looked through it on my phone once."

Several residents explained they access the Internet several times a day to obtain medical information. In the words of one resident, "I use my phone or the computer to guide my learning ten or fifteen times over the course of the day. I don't know how people trained in residency before things like 'Up-To-Date' and other Internet resource were available."

3.4.2 Technology

When asked how the resource could be improved, most residents had little to say. For example, one resident stated, "I don't think you need to do that [make improvements]. It is well laid out and when I actually need it, it will be there for me." When asked if anything could be done differently that would have kept interest, any suggestions made were with regard to using more interactive technology. In the words of one resident, "If we could incorporate some videos and interactive quizzes, that would encourage you to keep going and motivate you some more." Another resident suggested adding videos to 'change it up'. "I don't know if some videos would be handy. It wasn't necessary because all of the information is there and readable, but sometimes to change up the way you are learning." Another resident communicated, "Maybe going through some case discussions in a video format."

Two residents suggested the resource could be improved by reducing the number of drop down menus. A couple of learners suggested implementing quizzes. "Maybe doing an interactive quiz after each module to see if you have retained the information."

A few learners suggested more diagrams and animation. One learner suggested, "The content was great. There are a few things I think could benefit from an animation for the visual learner." A second learner testified, "Anatomical stuff would have benefited from a little animation or more pictures to showcase. I am not a visual learner so it was not a big thing for me. I can see a lot of people wanting something like that." A third resident stated, "More pictures and animation would be an improvement, but I don't think there was anything that was a glaring concern or omission. I thought it was well done."

3.5 Outcomes

Residents' responses regarding outcomes from the *Caring for Persons with Spinal Cord Injury* online learning resources emerged into six themes: *New Knowledge, Bookmarked, Raised Awareness, Sharing with Colleagues, Application,* and *Increased Comfort*. These three themes are discussed in the following sections.

3.5.1 New Knowledge

Residents stated they learned new knowledge as a result of going through the resource. Several residents commented on the value of learning about autonomic dysreflexia. One resident specified, "I definitely gained new knowledge, especially regarding autonomic dysreflexia. And then I gained a deepened knowledge around respiratory issues." A second resident also confirmed they attained new knowledge from participating in the resource; "The autonomic dysreflexia one was really huge. Every module brought it back up again as the major life threatening complication with SCI. You mustn't miss it. This is

important." A third resident confirmed what they learned was, "Things to watch out for, testing patients creatinine every year and autonomic dysfunction with regard to blood pressure." Similarly, a resident shared; "The wound care, the dysreflexia… just understanding the classifications of functional ability. It is going to make me much less afraid of how to approach the issues with patients with SCI and much less of this nebulous black box." Other residents commented their learning addressed a knowledge gap, "It really did address a big gaping hole in my knowledge and approach to things, particularly in spinal cord injuries." Some learners suggested the learning research broadened their knowledge. Others said the SCI resource increased their knowledge of respiratory complications:

> The thing I didn't appreciate before is that people with SCI are susceptible to a lot of respiratory infections. That is something that I will now keep in the back of my mind and will make sure that I am doing frequent checks. If they come in with any kind of cough or cold I don't want to tell them not to worry and it is viral. I will probably do some more investigations.

3.5.2 Bookmarked

One indication that residents plan to access the modules in the future is that several reported they booked marked the resource. One resident stated, "I bookmarked it. I am going to use it soon for studying for the CCFP exam (certification exam). It is something I am going to use for the foreseeable future." Another resident commented, 'I bookmarked it on my browser because I thought it was really useful." Another resident shared that he felt the resource was worth bookmarking. "It was easy access and then I bookmarked it so I can go back." Lastly, a resident shared why she bookmarked the SCI resource:

> I was very impressed. I found a lot of information that I didn't previously know a lot about. I thought the layout was really good separating it into topics as well as breaking the topics down. There were some good images. I bookmarked it so I can keep coming back to it.

3.5.3 Raised Awareness

One consistent outcome residents reported was a raised awareness of the treatment of SCI. One resident shared, "It just gave me some context so if I do come across it [SCI] I won't be totally out of the water with knowing what to do." Another resident stated; "The pathophysiology part is very useful, because it explained concepts. I didn't know how lacking my knowledge was." A second resident shared he gained an awareness of medical complications regarding persons with SCI; "I wasn't aware that spinal cord injury patients are susceptible to respiratory infections. That opened my eyes. I would have probably missed it if I had not gone through the modules." Another resident shared how she became a lot more aware of the needs of persons with SCI as a result of completing the resource. In her words:

> When I was younger I used to teach skiing. I met people with SCI. The resource provided me with a lot more depth to what I have seen in the past and not really understood. I have a well of information to draw.

Another resident agreed and stated, "Yes, I am more aware of things that need to be discussed on regular follow-up visits." Finally, a resident revealed that

being more aware of issues related to SCI will make her change to being more proactive when treating persons with SCI in the future; "Knowing and being aware about autonomic dysreflexia. I am going to be more thorough in examination with skin changes and be more active in trying to prevent that. Little practice changes and being more proactive."

3.5.4 Sharing with Colleagues

A few residents stated they discussed the resource with other residents or their supervisors. One resident said that after completing the learning resource she realized areas where she could have managed things better in the past. "I have talked over some of these topics with my supervisor in the clinic about patients we have seen. Reflecting back maybe I should have approached some of those situations differently." Another resident discussed her roommate's reaction to the resource; "My roommate is an Obstetrical/Gynecology resident. He looked over my shoulder and commented on how helpful it looked and was asking questions. He thought it was pretty cool." Another resident reported she shared the learning resource with her mother who is a family physician. "She is a family physician in town and I told her it is a really great resource to have in your back pocket. She also liked that checklist at the end." One resident considered posting it on twitter to let others know it is available and valuable; "I am on Twitter and have a lot of followers that are in medicine. I use it as a knowledge translation tool. I could post it and say it is a good resource to check it out." Finally, one resident stated he hoped his colleagues could see the resource, "I hope that all of my colleagues go to look at. I thought it was a really great resource and am going to use this."

3.5.5 Application

Several residents reported that after completing the resource, they realize they could have managed the treatment of SCI patients better in the past. They went on to say they intend to apply their new knowledge next time. One resident confided:

> Autonomic dysreflexia, looking back I have seen it before and didn't recognize it. That module stuck in my mind as something that is going to be on my differential for certain patient presentations. Being able to effectively counsel patients around what they might be experiencing and how to have better prevention.

Another resident discussed how he intends to implement what he learned as a result of completing the resource; "Before this module, those things didn't cross my mind. I actually saw a patient [since doing the module] and approached them differently. He had some of the symptoms so I was more comfortable talking to him about it." One resident reflected:

> Looking back I had two patients that I had seen that I should have asked about things or been more aware about blood pressure or checking for ulcers. Now seeing patients it changes what questions I ask and how long I speak to them.

Finally, a resident stated, "Talking with the patient after I had done the module, he was very aware of the things I learnt. So just reminding myself that most of those patients are very knowledgeable."

3.5.6 Increased Comfort

Several residents commented on how the resource increased their comfort regarding treating persons with SCI. One resident explained:

> I feel so much more prepared. This is something I didn't know before. If I encounter a person who has SCI in the emergency department who is feeling unwell at all, check the bladder, check about pain, constipation, bedsores, any sort of skin breakdown. It helped me develop a good approach. It could be something just as simple as a full bladder. That was really helpful.

One resident also concluded that as a result of what she learned she too is more comfortable treating persons with SCI. "The algorithms, especially in some of the emergency management in autonomic dysreflexia is what comes to mind. I found that resource was excellent and laid out very clearly. I would be much more comfortable dealing with many of these issues." Another resident admitted he went into the module knowing this was an area that he had a knowledge gap. "I came out of it feeling much more comfortable in the topic and much more engaged that there is a lot more to learn here. That is definitely going to be something to look into in the future."

4. Quantitative Survey Results

Details of the survey results for the module can be found in tables 1.1-1.5 of Appendix C. Twenty-eight participants completed the evaluations for the modules *Caring for Persons with SCI*. Overall, all participants were pleased with the modules, and they found them to be authentic, relevant and interactive. Scores for all the constructs were extremely high, with the vast majority of responses being either agree or strongly agree. It should be noted that the constructs of *service, media* and *content* had the highest responses.

4.1 Structure

With regards to the structure of the modules, the majority of responses from the participants were positive. All 28 of the completed surveys indicated residents felt the resource met their needs with regards to content, that the resource was relevant and that the resource engaged them in the learning experience. Twelve out of 28 participants disagreed that the modules provided opportunities for problem-solving experiences and 11 out of 28 disagreed that the module provided opportunities to apply material learned. Eight out of 28 participants indicated in the open-ended question regarding structure that problem solving or case studies would be a useful addition in order to make the modules more interactive.

4.2 Content

With regards to content, the residents' opinions were also positive. Twenty-eight out of 28 felt the content was of appropriate depth and breadth, and that the content included information that would help them in their personal or professional lives. Twenty-seven out of 28 indicated that the content was accurate and free of errors, was well-organized and that the resource included sufficient online resources. In the open-ended question regarding content, residents indicated that while the resource was a bit repetitive, it provided useful treatment recommendations, helpful hyperlinks and diagrams, and that

the illustrations and pop-ups were effective methods of presenting treatment options.

4.3 Media

Responses related to media were also extremely strong, in particular with regards to the accessibility of the content. Twenty-eight out of 28 residents responded that the resource was easy to navigate, provided relevant and appropriate use of technology, facilitated a meaningful learning experience, and allowed them to learn using their preferred learning style. Several residents indicated in the open-ended question on media that videos would be useful tools to present cases, and that the vertical scrolling could be reduced on some pages.

4.4 Service

Residents gave the highest marks for service, particularly with regards to the expertise and level of knowledge presented. All 28 residents indicated that the resource respected their experience and knowledge, and that the subject matter experts were qualified and experienced in the industry. Twenty-seven out of 28 responded that there was easy access to support tools, information and help. In the open-ended question on service, several residents indicated that the numerous linked resources (particularly the patient handouts) were useful additions that they would utilize in the future.

4.5 Outcomes

The responses to the outcomes of the module were positive like the other four constructs. Twenty-eight out of 28 residents said that the resource was interesting, valuable, and that as a result of their participation in the modules that they understood new principles. However residents did not respond as favorably when asked if they had acquired proficiency in new techniques (8 disagree, 4 not applicable) or when asked if they would initiate new ideas and/or projects in the workplace (4 disagree, 6 not applicable). Several residents indicated in the open-ended question on outcomes that while the modules were an informative resource tool, it did not give them proficiency in techniques.

5. Discussion and Conclusion

The strongest finding that emerged from this evaluation was that residents were convinced *Caring for Persons with Spinal Cord Injury* is a valuable, accessible online resource addressing an important topic not adequately covered in medical training. There is so much information to cover in a two-year family medicine program, that curriculum priorities are often established by conditions seen most frequently. Most residents admitted the reality is they don't expect to remember the content in the SCI learning resource but will remember to access the resource when they need the information in a "just-in-time" manner.

Understanding the needs of the audience is a prerequisite to effectively planning any learning event (MacDonald et al., 2004). When designing online learning resources, being aware of and adhering to the needs of the audience is important to ensure that the resource will be effective (MacDonald et al., 2001). Because family physicians are generalists who treat patients with a broad spectrum of

medical conditions, the reality is they are unable to know everything they need to know on every condition and situation. Residents in this study confirmed that by designing the SCI resource so it can be accessed anytime and anywhere there is an Internet connection will enable them to retrieve information from it on a need to know basis.

Several residents commented that in addition to treating persons with SCI, the information on pressure ulcers, constipation and degenerative disk disease make the resource also valuable to use in several medical situations and with a variety of patients. Designing quality online learning experiences requires considerable resources in terms of time, effort and money. Creating a resource that is adaptable to different situations is a sign of quality eLearning design and critical in the healthcare economic climate. Residents reported the resource was versatile and had applicable information for treating a variety of patients. Reusability, generativity, and adaptability are important characteristics of quality learning resources and a value-added component of any quality-learning event (MacDonald et al., 2001).

Residents identified several pedagogical strategies used in the learning resource that took advantage of new technologies and utilized scenarios drawn from real-life situations. It is therefore important to revisit teaching practices to take advantage of the possibilities offered by new technologies (Mejias, 2006). In this study residents acknowledge the content was authentic, comprehensive and utilized pedagogical strategies incorporated in scenarios drawn from real-life situations.

When asked what they thought of the resource, residents consistently commented that it was organized, followed a logical progression, and was filled with useful knowledge, resources and links. Residents conveyed they appreciated having the information they needed on SCI conveniently located in one place and repeatedly commented they found the links providing access to numerous resources beneficial.

Every resident reported they found the resource user-friendly and easy to navigate. Several residents stated they appreciated the fact that the resource was online. Although a few residents stated they glanced at the resource on their phone, most reported they hadn't tried to access the resource on their phone but completed the resource on their desktop computer. Several residents explained they access the Internet several times a day to obtain medical information.

When learning resources contain relevant information integrating clinical experiences and learning activities they tend to be motivated to access and complete a learning resource (MacDonald et al., 2001). When asked if anything could be done differently that would have kept interest, suggestions included using more interactive technology.

Residents stated they learned new knowledge as a result of going through the resource. Several of these residents commented specifically on the value of

learning about autonomic dysreflexia. Other residents commented the SCI resource increased their knowledge of respiratory complications, and wound care. One indication that residents plan to access the resource in the future is that several reported they book marked the resource.

One consistent outcome residents reported from participating in the resource was a raised awareness of the treatment of SCI. Residents revealed that being more aware of issues related to SCI will help them become more proactive when treating persons with SCI in the future. A few residents stated they discussed the resource with other residents, their supervisors, residents in other disciplines and family physicians.

In addition to raising awareness and knowledge regarding what to look for and how to treat issues related to SCI, several residents reported that after completing the SCI resource, they realized they could have managed the treatment of a SCI patient better in the past had they completed the resource earlier, and they intend to apply their new knowledge next time. Several residents commented on how the resource increased their comfort regarding treating persons with SCI.

There are limitations to this study. The sample group was 28, which may influence the range of responses; however there was great consistency in the themes that emerged. The residents participating in this study were from one particular location of a single family medicine residency program. Residents might be considered to be more technologically astute then more experienced family physicians and therefore might have different opinions. Lastly, more clinically experienced family physicians may have different learning styles and needs and therefore more research with this group may be necessary.

In conclusion, residents reported they enjoyed the SCI learning experience and learned new information and raised their awareness with regard to diagnosing, treating and managing persons with SCI. Residents confirmed that by designing the SCI resource so it can be accessed anytime and anywhere there is an Internet connection will enable them to retrieve information from it on a need to know basis. Therefore, in response to the research question, structuring and designing a SCI resource that can be accessed conveniently online is a viable approach to providing relevant authentic information to physicians and/or residents regarding this vulnerable patient population.

By sharing critical information in a convenient online format we hope to reduce the number of hospital emergency visits and secondary complications that occur in persons with SCI by increasing the comfort level and knowledge of family physicians who care for this unique population.

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Appendix A: W(e)Learn Post-module Survey

For the following questions, the available response options are: Strongly disagree, Disagree, Strongly agree, Agree, Not applicable

Content

1) The content is of appropriate depth and breadth
2) The content is well organized
3) The content is accurate and free of errors
4) The content includes information that will help me in my personal and/or professional life.
5) The content includes information I will be able to use in my personal and/or professional situations
6) The content includes sufficient online resources

Media

7) In this resource it was easy to "navigate" through the content.
8) Website features provide relevant and appropriate use of technology
9) The instructions are divided into clear and logical sections
10) Presentation of material utilizes aesthetically pleasing graphics
11) Presentation of material utilizes effective pop-up menus and windows
12) The choice of technological tools facilitates a meaningful learning experience
13) The choice of technological tools allow me to learn using my preferred learning style

Service

14) The resource respects my experience and knowledge
15) The subject matter experts are qualified and experienced in the industry
16) There is easy access to support tools, information, and help
17) There is easy access to related web-sites

Structure

18) The resource meets my needs with regards to content
19) The resource meets my needs with regards to media
20) The resource kept my interest
21) The resource motivates me to learn
22) The resource is relevant
23) The resource engages me in the learning experience
24) The material follows a logical progression
25) The modules provides opportunities for problem-solving experiences
26) The modules provide opportunities to apply material learned
27) The material challenges and supports my ideas

Outcomes

28) Engaging in this resource minimises or eliminates travel expenses related to furthering my professional education
29) The resource is interesting
30) The resource is valuable
31) As a result of my participation in these modules I understand new principles
32) As a result of my participation in these modules I have acquired proficiency in new techniques
33) As a result of my participation in these modules I will initiate new ideas and/or projects in the workplace

Please complete the following statements:

1. The most valuable aspect of the resource is
2. The design or delivery of this resource could be improved by…
3. What, if anything, did you learn in this resource that you will apply in either your personal or professional life?

Appendix B: Semi-Structured Interview Questions

1. Why are you interested in this topic?

Content

2. Can you describe your overall experience using the online Caring for Persons with Spinal Cord Injury learning resource?
3. Did the module address the learning objectives stated at the beginning of the module?
4. How did you find the content)?
5. Was the content relative to your personal and/or professional life?

Media

6. How did you find the navigation through the content of the learning resource?
7. Did the resource features provide appropriate use of technology?
8. Did you find the choice of technological tools facilitated a meaningful learning experience?
9. Where you able to identify with some of the scenarios presented in the module? If so, how did their experiences affect you?

Service

10. Was the program easy to access?
11. Were the modules easy to navigate through? Were there any technical difficulties that you encountered?
12. Was there easy access to support tools, information, and help?
13. How did you find the access to related web-sites?

Structure

14. Did the resource address your learning needs?
15. Did the modules keep your interest?
16. Did the module(s) follow a logical progression?
17. Did the modules keep your interest and keep you motivated to learn?

Outcomes

18. Did you gain new knowledge and skills that have learned through participating in this resource? If so, can you give an example of this?
19. Have you changed your understanding of the "topic" as result of taking the modules? If so, have you shared what you have learned with your colleagues/classmates?
20. What, if anything, did you learn in this resource that you will apply in either your personal or professional life?
21. Will you use this resource in the future? If so, why/how?
22. What was the best part of the module?
23. What was your least favourite part of the module? What, if anything, was missing from this learning experience? Please give examples.
24. How could the modules be improved?

Appendix C

Table 1.1: Trainees' Responses to the Structure Items for Caring for Persons with SCI Program Evaluation (N=28)

#	Answer Options	Response Options				
		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	The resource meets my needs with regards to content	0	0	12	16	0
2	The resource meets my needs with regards to media	0	3	13	12	0

3	The resource kept my interest	0	1	17	10	0
4	The resource motivates me to learn	0	2	13	13	0
5	The resource is relevant	0	0	8	20	0
6	The resource engages me in the learning experience	0	0	18	10	0
7	The material follows a logical progression	0	1	6	21	0
8	The modules provide opportunities for problem-solving experiences	0	12	8	8	0
9	The modules provide opportunities to apply material learned	0	11	8	9	0
10	The material challenges and supports my ideas	0	1	17	9	1

Table 1.2: ***Trainees' Responses to the Content Items for Caring for Persons with SCI Program Evaluation (N=28)***

#	Answer Options	Response Options				
		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	The content is of appropriate depth and breadth	0	0	11	17	0
2	The content is well organized	0	3	11	17	0
3	The content is accurate and free of errors	1	0	18	9	0
4	The content includes information that will help me in my personal and/or professional life	0	0	12	16	0
5	The content includes information I will be able to use in my personal and/or professional situations	0	0	12	15	1
6	The content includes sufficient online resources	0	1	12	15	0

Table 1.3: Trainees' Responses to the Service Items for Caring for Persons with SCI Program Evaluation (N=28)

#	Answer Options	Response Options				
		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	The resource respects my experience and knowledge	0	0	11	17	0
2	The subject matter experts are qualified and experienced in the industry	0	0	14	14	0
3	There is easy access to support tools, information, and help	0	0	14	13	1
4	There is easy access to related web-sites	0	1	13	13	1

Table 1.4: Trainees' Responses to the Media Items for Caring for Persons with SCI Program Evaluation (N=28)

#	Answer Options	Response Options				
		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	In this resource it was easy to "navigate" through the content	0	0	9	19	0
2	Website features provide relevant and appropriate use of technology	0	0	14	14	0
3	The instructions are divided into clear and logical sections	0	1	9	19	0
4	Presentation of material utilizes aesthetically pleasing graphics	0	1	14	13	0
5	Presentation of material utilizes effective pop-up menus and windows	0	3	11	14	0
6	The choice of technological tools facilitates a meaningful learning experience	0	0	15	13	0
7	The choice of technological tools allow me to learn using my preferred learning style	0	0	17	11	0

Table 1.5: Trainees' Responses to the Outcome Items for Caring for Persons with SCI Program Evaluation (N=28)

#	Answer Options	Response Options				
		Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1	Engaging in this resource minimizes or eliminates travel expenses related to furthering my professional education	0	0	15	8	5
2	The resource is interesting	0	0	18	10	0
3	The resource is valuable	0	0	8	20	0
4	As a result of my participation in these modules I understand new principles	0	0	13	15	0
5	As a result of my participation in these modules I have acquired proficiency in new techniques	0	8	9	7	4
6	As a result of my participation in these modules I will initiate new ideas and/or projects in the workplace	0	4	14	4	6